

New species and record of black flies (Diptera: Simuliidae) from Samar, the Philippines

Hiroyuki TAKAOKA¹⁾ and Victor F. TENEDERO²⁾

¹⁾ Department of Infectious Disease Control, Faculty of Medicine, Oita University,
Hasama, Yufu City, Oita, 879–5593 Japan

²⁾ West Ayala Condominium, 252 Sen. Gill. Puyat Ave.,
Makati, Metro Manila, 1, 200 Philippines

(Received: 5 September 2008; Accepted: 16 October 2008)

Abstract: A preliminary survey of black flies was carried out in Samar, the Philippines, and seven species assigned to three subgenera of the genus *Simulium* were collected: *S. (Gomphostilbia) bicolense* Takaoka, *S. (G.) repentinum* sp. nov., *S. (G.) salazarae* Takaoka, *S. (G.) samarense* sp. nov., *S. (Simulium) baltazarae* Delfinado, *S. (Wallacellum) tuyense* Takaoka and *S. (W.)* sp. All of these species but *S. (S.) baltazarae* are added as new records from Samar. The two new species of the subgenus *Gomphostilbia* are described based on reared male and pupal specimens.

Key words: black fly, Simuliidae, Philippines, Samar, taxonomy

The simuliid fauna of Samar, an eastern-most large island of the Visayan region, the Philippines, has been poorly studied. Only one species, *Simulium (Simulium) baltazarae* Delfinado, has been recorded (Delfinado, 1962).

Recently, we surveyed the pupae and larvae of black flies in 13 lowland streams of Western and Northern Samar Provinces, Samar, and obtained a total of seven species assigned to three subgenera of the genus *Simulium*: i.e., *S. (Gomphostilbia) bicolense* Takaoka, *S. (G.) salazarae* Takaoka, *S. (G.)* sp. nov. (A), *S. (G.)* sp. nov. (B), *S. (Simulium) baltazarae* Delfinado, *S. (Wallacellum) tuyense* Takaoka and *S. (W.)* sp. In this paper, all these species but *S. (S.) baltazarae* are added as new records from Samar, and the two new species of the subgenus *Gomphostilbia* are described on the basis of reared male and pupal specimens.

The terms for morphological features used here follow those of Takaoka (2003). Type specimens of the new species are deposited at the Department of Infectious

Disease Control, Faculty of Medicine, Oita University, Oita, Japan.

Simulium (Gomphostilbia) bicolense Takaoka

Simulium (Gomphostilbia) bicolense Takaoka:
1983: 82–83 (female, male, pupa and mature larva).

SPECIMEN EXAMINED. 1 female (with associated pupal exuviae and cocoon), reared from a pupa, collected from a small stream (width 1.5–3.0 m, water temperature 24.0°C, shaded, altitude 50–75 m), moderately flowing in a forest, Barangay Mawacat, Western Samar Province, Samar, Philippines, 19.II.2008, by H. Takaoka and V. F. Tenedero.

DISTRIBUTION. Luzon and Samar
(**New record**).

Simulium (Gomphostilbia) repentinum sp. nov.

DESCRIPTION. **Male.** Body length 2.3 mm.

Head. Wider than thorax. Upper eye consisting of 12 vertical columns and 12 horizontal rows of large facets. Face brownish-black, white pruinose. Clypeus brownish-black, white pruinose, densely covered with yellow scale-like short to medium-long hairs (except medial portion of lower 2/3 bare) interspersed with several dark brown simple longer hairs on lower 1/2. Antenna composed of scape, pedicel and 9 flagellomeres (right antenna shows incomplete separation between 2nd and 5th flagellomeres, Fig. 1A), yellow except apical 4 flagellomeres light brown; 1st flagellomere elongate, 2.21 times as long as 2nd one. Maxillary palp with 5 segments, light brown, proportional lengths of 3rd, 4th, and 5th segments 1.00: 1.19: 3.01; 3rd segment (Fig. 1B) of moderate size; sensory vesicle (Fig. 1B) ellipsoidal, small, 0.16–0.20 times as long as 3rd segment, and with medium-sized opening. **Thorax.** Scutum yellowish-brown to medium brown, slightly shiny when illuminated at certain angle of light, densely covered with golden-yellow short hairs; scutellum yellowish-brown, with golden-yellow short hairs and dark brown long upright hairs. Postnotum medium brown, slightly white pruinose and bare. Pleural membrane bare. Katepisternum medium brown, longer than deep, moderately covered with dark brown short hairs and golden-yellow ones. **Legs.** Foreleg: coxa whitish-yellow; trochanter light brown except base whitish-yellow; femur light brown though apex somewhat lighter; tibia light to medium brown though extreme base somewhat lighter, moderately covered with golden-yellow hairs on outer surface of basal 3/4; tarsus medium brown, with moderate dorsal hair crest; basitarsus moderately dilated, 6.76 times as long as its greatest width. Midleg: coxa light brown except posterior surface dark brown; trochanter yellow except posterior surface slightly darkened; femur light brown; tibia light to medium brown except basal 2/5 yellow; tarsus medium to dark brown. Hind leg (Fig. 1C): coxa yellow; trochanter yellow; femur light brown except base yellow and apical cap medium brown; tibia yellow except little less than apical 2/5 medium to dark brown, moderately covered with golden-yellow hairs on basal 3/5 or more; tarsus dark brown except little more than basal 2/3 of basitarsus and basal 1/2 of 2nd tarsal segment yellowish-white though base of basitarsus dark brown;

basitarsus narrow, nearly parallel-sided, 6.09 times as long as wide, and 0.55 and 0.44 times as wide as greatest widths of tibia and femur, respectively; calcipala elongate, extending little beyond middle of 2nd tarsal segment, 1.62 times as long as wide, and 0.59 times as wide as greatest width of basitarsus; pedisulcus well developed. **Wing.** Length 1.5 mm. Costa with dark spinules and hairs except basal portion with patch of golden-yellow hairs. Subcosta bare. Hair tuft on stem vein golden-yellow. Basal portion of radius fully haired; R_1 with dark spinules and hairs; R_2 with dark hairs only. Basal cell absent. **Abdomen.** Basal scale yellow, with fringe of yellow long hairs. Dorsal surface of abdomen medium brown to brownish-black except 2nd segment yellow, covered with dark short to long hairs; segment 2 with pair of slightly shiny dorsolateral patches and segments 5–7 each with pair of shiny dorsolateral patches. **Genitalia.** Coxite in ventral view (Fig. 1D) nearly rectangular, 1.79 times as long as its greatest width. Style in ventral view (Fig. 1D) slender, slightly tapered toward apex, 0.75 times as long as coxite, slightly bent inward, with spine apically (left side) or subapically (right side); style in ventrolateral view (Fig. 1E, F) slightly narrowed from base to little beyond middle, then tapered toward apex, with round apex. Ventral plate in ventral view (Fig. 1D) transverse, 0.41 times as long as wide, widest in middle, narrowed posteriorly, with anterior margin produced anteromedially, and posterior margin nearly straight (or very slightly concave medially when viewed at slightly inclined angle), and densely covered with microsetae on ventral surface; basal arms of moderate length, nearly parallel-sided, then slightly converged apically; ventral plate in lateral view (Fig. 1G) much produced ventrally; ventral plate in end view (Fig. 1H) triangular ventrally, and densely covered with microsetae on posterior surface except both lateral areas mostly bare. Median sclerite (Fig. 1D, G) connected to ventral plate near anterior margin (its shape not observable due to thinness and weak pigmentation). Paramere (Fig. 1I) enlarged, rounded toward ventral plate, with 3 distinct long and stout hooks and 4 or 5 smaller ones close together near apex. Aedeagal membrane (Fig. 1I) transparent, very sparsely covered with minute setae, not sclerotized basally, and not forming dorsal plate. Ventral surface of 10th

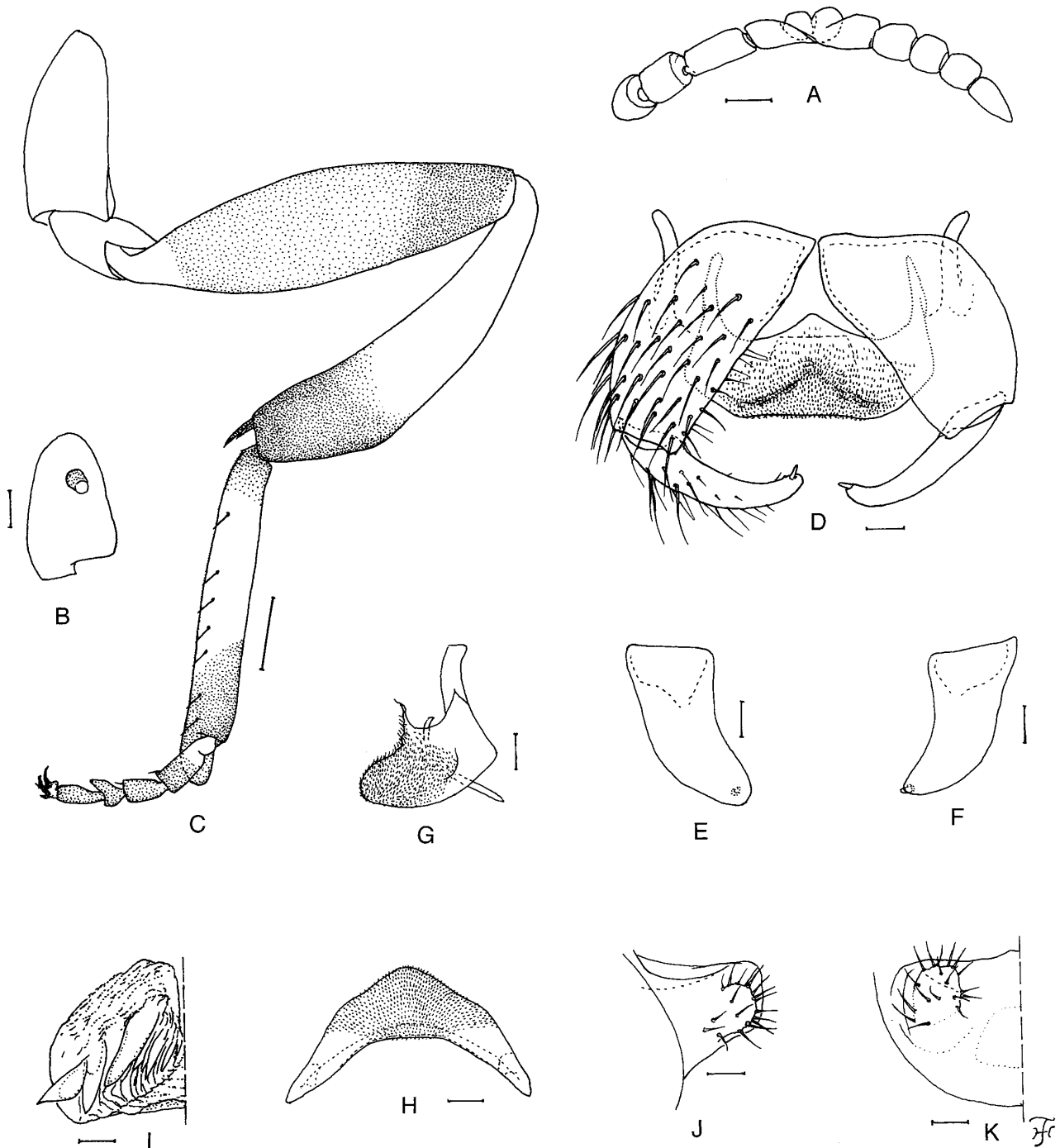


Fig. 1. Male of *Simulium* (*Gomphostilbia*) *repentinum* sp. nov. A, right antenna showing incomplete separation of flagellomeres (inner view); B, 3rd segment of maxillary palp with sensory vesicle (right side and front view); C, hind leg (left side and outer view); D, coxites, styles, ventral plate and median sclerites (only basal portion shown, by dashed lines, above ventral plate) *in situ* (ventral view); E and F, style (ventrolateral view; E, right side; F, left side); G, ventral plate and median sclerite *in situ* (lateral view); H, ventral plate (end view); I, right paramere and right half of aedeagal membrane (end view); J, and K, 10th abdominal segment and cercus (right side; J, lateral view; K, end view). Scale bars. 0.1 mm for C; 0.05 mm for A; 0.02 mm for B and D–K.

abdominal segment (Fig. 1J, K) without distinct hairs near posterior margin on each side. Cercus (Fig. 1J, K) rounded, with 18 hairs.

Pupa. Body length 2.6 mm. **Head.** Integu-

ment yellow, sparsely or moderately covered with small round tubercles (Fig. 2A); antennal sheath without any protuberances or tubercles; frons with 2 (or 3 in the paratype pupa) pairs of

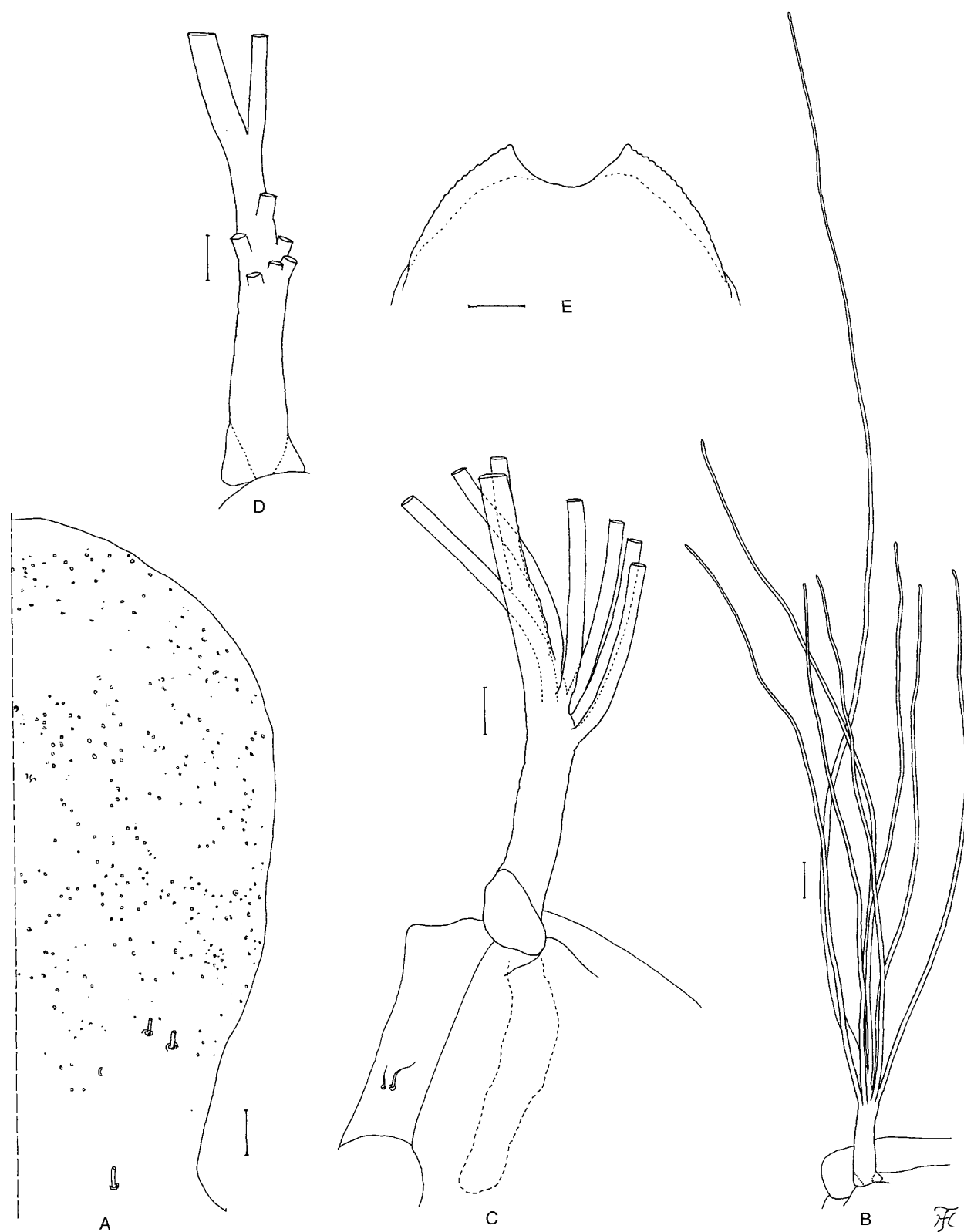


Fig. 2. Pupa of *Simulium* (*Gomphostilbia*) *repentinum* sp. nov. A, frons and portion of face (left half; trichomes omitted); B, gill filaments (left side and dorsal view); C and D, basal portion of gill filaments (left side; C, dorsal view; D, lateral view); E, plate-like terminal hooks (anterodorsal view). Scale bars. 0.1 mm for B; 0.05 mm for A, C and D; 0.02 mm for E.

simple very long trichomes with or without coiled apices, and face with pair of simple very long trichomes with coiled apices; 3 frontal trichomes on each side arising close together, subequal in length to one another and slightly longer than facial one. **Thorax.** Integument yellow, nearly smooth except dorsoposterior area covered with tubercles, with 3 simple very long mediodorsal trichomes with coiled apices, 2 simple very long anterolateral trichomes (1 stout, with coiled apex, 1 slender, with uncoiled apex), 1 simple medium-long posterolateral trichome with uncoiled apex and 3 simple ventrolateral trichomes with uncoiled apices (1 very long, 1 medium-long, 1 short) on each side. Gill (Fig. 2B–D) composed of 8 slender thread-like filaments, arranged in groups of 1 + 1 + 1 + 1 + 1 + 1 + 2 filaments: outer filament of paired filaments longest (3.2 mm) and thickest of all, other filaments subequal in length (1.6–2.0 mm) and thickness to one another; common basal stalk medium-long, with somewhat swollen transparent organ ventrally at base; all filaments light brown, gradually tapered toward apex; annular ridges and furrows well marked on longest filament but almost indistinct on other filaments; all filaments densely covered with minute tubercles. **Abdomen.** Dorsally, segments 1 and 2 with no tubercles; segment 1 with 1 simple slender medium-long hair-like seta on each side; segment 2 with 1 simple slender medium-long hair-like seta and 5 very short setae submedially on each side; segments 3 and 4 each with 4 hooked spines and 1 very short somewhat spinous seta on each side; segment 5 lacking spine-combs; segments 6–8 each with spine-combs in transverse row and comb-like groups of minute spines on each side; segment 9 with comb-like groups of minute spines on each side and pair of distinct flat plate-like terminal hooks extending laterally and having weakly serrated outer margin (Fig. 2E). Ventrally, segment 4 with 1 simple short brown hooklet and few simple slender very short setae on each side; segment 5 with pair of bifid hooks submedially and few very short simple slender setae on each side; segments 6 and 7 each with pair of bifid or trifid inner and simple outer hooks somewhat spaced from each other and few very short simple slender setae on each side; segments 4–8 with comb-like groups of minute spines. Each side of segment 9 with 3 grapnel-shaped hooklets. **Cocoon.** Wall-pocket shaped, thinly

and neatly woven, widely extending ventrolaterally; anterior margin somewhat thickly woven, without any bulge or projection anterodorsally; posterior 1/2 with floor moderately woven; individual threads invisible; 3.0–3.2 mm long by 2.0–2.3 mm wide.

Female and Mature larva. Unknown.

TYPE SPECIMENS. Holotype male (with its associated pupal exuviae and cocoon) in ethanol, reared from a pupa collected from a stream (width 1–2 m, stream bed rocky, water temperature 24.0°C, shaded, altitude 30–50 m), moderately flowing in a coconut plantation, Barangay Cagboborac, Northern Samar Province, Samar, Philippines, 21. II. 2008, by H. Takaoka and V. F. Tenedero. Paratype, 1 pupa collected from a small stream (width 0.2–0.5 m, stream bed of rocks and stones, water temperature 25.0°C, exposed to sun, altitude 110–130 m), moderately flowing in a coconut plantation, Barangay Magsaysay, Western Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero.

ECOLOGICAL NOTES. The pupae of this new species were collected from grasses in the water, together with *S. (G.) salazarae* and *S. (Wallacellum) sp.*

ETYMOLOGY. The species name *repentinum* refers to the unexpected arrangement of the eight pupal gill filaments, of which six filaments are not grouped into the usual two triplets but directly arise from the basal common stalk. The Latin adjective “repentinus” means “unexpected”.

REMARKS. *Simulium (G.) repentinum* sp. nov. is assigned to the *batoense* species-group within the subgenus *Gomphostilbia* in that it has antennae with 11 segments, the pleural membrane bare, and a slender hind basitarsus (Fig. 1C) in the male, and eight gill filaments (Fig. 2B) in the pupa.

This new species is characterized by the eight pupal gill filaments composed of six

individual filaments and two paired filaments, of which the outer filament is much longer than the inner counter filament and six individual filaments (Fig. 2B). *Simulium* (G.) *serratum* Takaoka, described from pupal and larval specimens collected from Sulawesi, Indonesia (Takaoka, 2003), has a pupal gill that is very similar in the arrangement to that of this new species, but all the eight filaments are subequal in length (1.7–2.0 mm) to one another in *S.* (G.) *serratum*.

***Simulium* (*Gomphostilbia*) *salazarae*
Takaoka**

Simulium (*Morops*) *salazarae* Takaoka, 1983: 53–55 (female, male, pupa and mature larva).

Simulium (*Gomphostilbia*) *salazarae*: Takaoka, 2003: 52.

SPECIMENS EXAMINED. 6 females and 8 males (with associated pupal exuviae and cocoon), reared from a pupa, collected from a small stream (width 1.5–2.5 m, water temperature 24.0°C, shaded, altitude 50–75 m), moderately flowing in a coconut plantation, Barangay Cabatuan, Western Samar Province, Samar, Philippines, 19. II. 2008, by H. Takaoka and V. F. Tenedero; 7 females and 4 males (with associated pupal exuviae and cocoon), reared from pupae, collected from a small stream (width 1.0–10.0 m, water temperature 24.5°C, partially shaded, altitude 20 m), moderately flowing in a coconut plantation, Barangay Serbantes, Northern Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero; 3 females and 3 males (with associated pupal exuviae and cocoon), reared from pupae, collected from a stream (width 1–2 m, stream bed rocky, water temperature 24.0°C, shaded, altitude 30–50 m), moderately flowing in a coconut plantation, Barangay Cagboborac, Northern Samar Province, Samar, Philippines, 21. II. 2008, by H. Takaoka and V. F. Tenedero; 1 female (with associated pupal exuviae and cocoon), reared from a pupa, collected from a small stream (width 1.5–

3.0 m, water temperature 24.0°C, shaded, altitude 50–75 m), moderately flowing in a forest, Barangay Mawacat, Western Samar Province, Samar, Philippines, 19. II. 2008, by H. Takaoka and V. F. Tenedero; 1 female (with associated pupal exuviae and cocoon), reared from a pupa, collected from a small shallow stream (width 0.5–1.0 m, water temperature 24.0°C, shaded, altitude 70 m), moderately flowing in a coconut plantation, Barangay Pulit, Western Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero; 1 male (with associated pupal exuviae and cocoon), reared from a pupa, collected from a small stream (width 0.5–2.0 m, water temperature 24.5°C, shaded, altitude 70–100 m), moderately flowing in a forest, Barangay Alang-Alang, Western Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero; 1 male (with associated pupal exuviae and cocoon), reared from a pupa, collected from a small stream (width 0.2–0.5 m, stream bed of rocks and stones, water temperature 25.0°C, exposed to sun, altitude 110–130 m), moderately flowing in a coconut plantation, Barangay Magsaysay, Western Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero; 1 male (with associated pupal exuviae and cocoon), reared from a pupa, collected from a small shallow stream (width 2.0 m, water temperature 24.0°C, partially shaded, altitude 70 m), moderately flowing in a coconut plantation, Barangay Bayhu, Western Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero.

DISTRIBUTION. Bohol, Luzon, Mindanao and Samar (**New record**).

***Simulium* (*Gomphostilbia*) *samarense*
sp. nov.**

DESCRIPTION. Male. Body length 2.7 mm. **Head.** Wider than thorax. Upper eye consisting of 12 vertical columns and 12 or 13 hori-

zontal rows of large facets. Face brownish-black, white pruinose. Clypeus brownish-black, white pruinose, densely covered with yellow scale-like medium-long hairs interspersed with several dark brown simple longer hairs near ventral margin on each side. Antenna composed of scape, pedicel and 9 flagellomeres, whitish-yellow except apical 4 flagellomeres medium brown; 1st flagellomere elongate, 1.58 times as long as 2nd one. Maxillary palp with 5 segments, light brown, proportional lengths of 3rd, 4th, and 5th segments 1.00:1.06:2.44; 3rd segment (Fig. 3A–C) of moderate size; sensory vesicle (Fig. 3A–C) ellipsoidal or globular, 0.24–0.32 times as long as 3rd segment, and with large opening.

Thorax. Scutum medium brown, slightly gray pruinose and shiny on shoulders, widely along lateral margins and also widely on prescutellar area when illuminated at certain angle of light, densely covered with golden-yellow short hairs; scutellum medium brown, with golden-yellow short hairs and dark brown long upright hairs. Postnotum medium brown and bare. Pleural membrane bare. Katepisternum medium brown, longer than deep, moderately covered with dark brown short hairs and golden-yellow ones. **Legs.** Foreleg: coxa whitish-yellow; trochanter medium brown except base whitish-yellow; femur medium brown though apex somewhat lighter; tibia medium brown except extreme base whitish-yellow; tarsus dark brown, with moderate dorsal hair crest; basitarsus slightly dilated, 6.88 times as long as its greatest width. Midleg: coxa medium brown except posterior surface brownish-black; trochanter yellow except posterior surface light brown; femur medium brown though posterior surface of base somewhat paler; tibia medium to dark brown except extreme base whitish-yellow; tarsus medium to dark brown except little less than basal 1/2 dark yellow to light brown. Hind leg (Fig. 3D): coxa dark yellow to light brown except anterior 1/2 whitish-yellow; trochanter whitish-yellow; femur medium brown except base whitish-yellow and apical cap dark brown; tibia medium brown except basal 1/4 whitish-yellow and apical cap brownish-black, moderately covered with golden-yellow hairs on basal 3/5 or more; tarsus dark brown except basal 3/5 of basitarsus and basal 1/2 of 2nd tarsal segment yellowish-white though base of basitarsus dark brown; basitarsus narrow,

nearly parallel-sided, 5.83 times as long as wide, and 0.57 and 0.52 times as wide as greatest widths of tibia and femur, respectively; calcipala elongate, extending to middle of 2nd tarsal segment, 1.40 times as long as wide, and 0.44 times as wide as greatest width of basitarsus; pedisulcus well developed. **Wing.** Length 1.6 mm. Costa with dark spinules and hairs except basal portion with patch of golden-yellow hairs. Subcosta bare. Hair tuft on stem vein dark brown. Basal portion of radius fully haired; R_1 with dark spinules and hairs; R_2 with dark hairs only. Basal cell absent. **Abdomen.** Basal scale light brown, with fringe of yellow long hairs. Dorsal surface of abdomen medium to dark brown except entire area of 2nd segment and narrow area along anterior margin of 3rd segment yellow, covered with dark short to long hairs; segment 2 with pair of shiny large dorsolateral patches widely connected in middle to each other, segment 3 with pair of similar but smaller shiny patches on yellow anterior area, and segments 5–7 each with pair of shiny large dorsolateral patches narrowly connected in middle to each other along anterior margin; segments 8 and 9 each with pair of slightly shiny lateral patches when illuminated at certain angle of light. **Genitalia.** Coxite in ventral view (Fig. 3E) nearly rectangular, 1.65 times as long as its greatest width. Style in ventral view (Fig. 3E) slender, tapered toward apex, moderately bent inward, with spine subapically; style in ventrolateral view (Fig. 3F) very slightly narrowed from base to apical 1/4, then tapered toward apex, with round apex. Ventral plate in ventral view (Fig. 3E) transverse, 0.47 times as long as wide, widest in middle, much narrowed posteriorly, with anterior margin produced anteromedially, and posterior margin nearly straight (or very slightly concave medially when viewed at slightly inclined angle, Fig. 3G), and densely covered with microsetae medially on ventral surface; basal arms of moderate length, nearly parallel-sided; ventral plate in lateral view (Fig. 3H) slightly produced ventrally near posterior margin; ventral plate in end view (Fig. 3I) rounded ventrally, and densely covered with microsetae medially on posterior surface. Median sclerite (Fig. 3G, J) connected to ventral plate near anterior margin, wide, almost transparent except mediolongitudinal area slightly sclerotized. Paramere (Fig. 3K) of moderate size, with 7 or 8 distinct hooks decreasing in

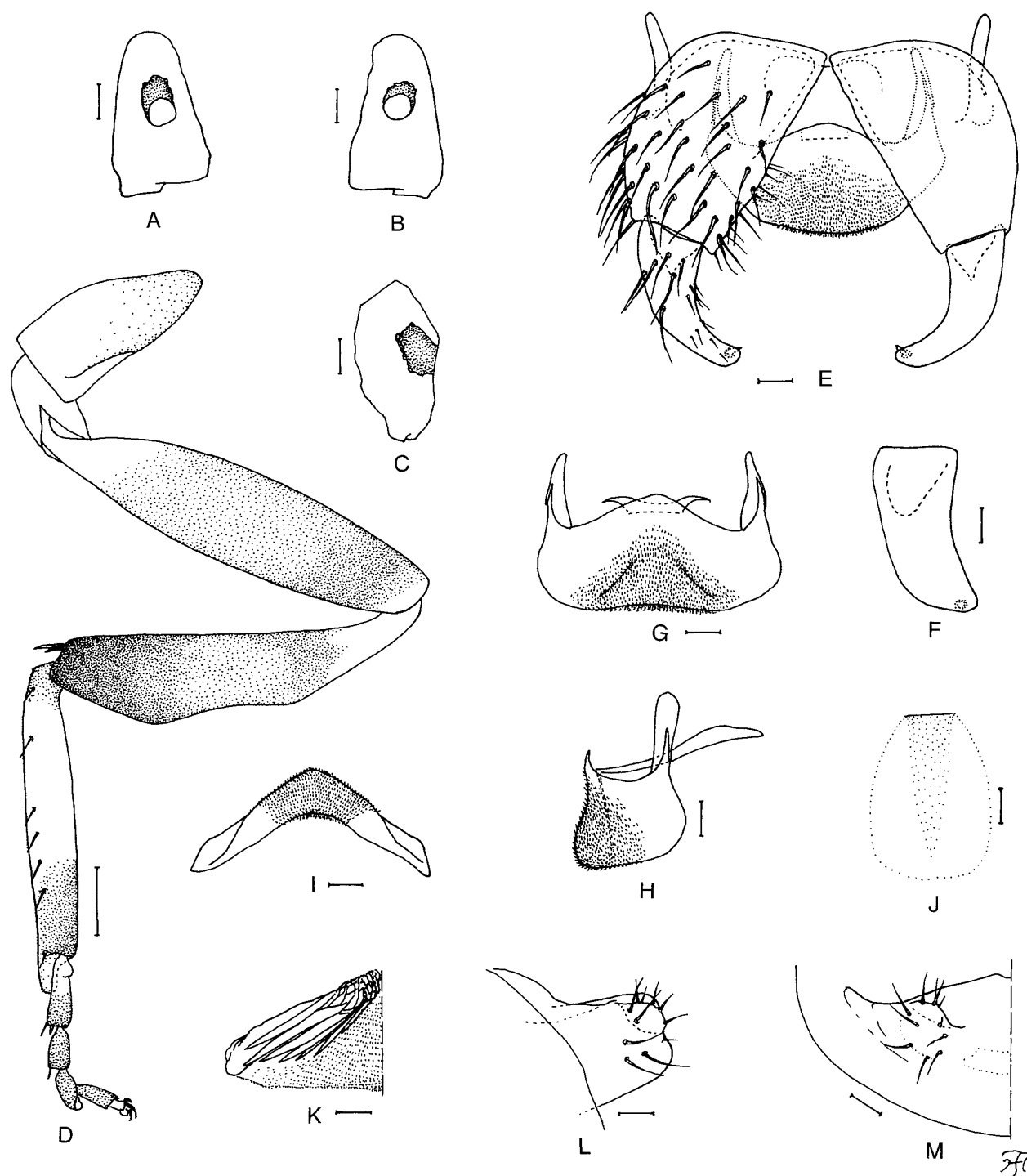


Fig. 3. Male of *Simulium* (*Gomphostilbia*) *samarense* sp. nov. A-C, 3rd segment of maxillary palp with sensory vesicle (A, right side and front view; B, left side and front view; C, right side and lateral view); D, hind leg (left side and outer view); E, coxites, styles, ventral plate and median sclerite (only basal portion and tip shown as dashed lines) *in situ* (ventral view); F, style (right side and ventrolateral view); G, ventral plate and median sclerite *in situ* (ventral view, though slightly inclined); H, ventral plate and median sclerite *in situ* (lateral view); I, ventral plate (end view); J, median sclerite (posterodorsal view); K, right paramere and right half of aedeagal membrane (end view); L, and M, 10th abdominal segment and cercus (right side; L, lateral view; M, end view). Scale bars. 0.1 mm for D; 0.02 mm for A-C and E-M.



Fig. 4. Pupa of *Simulium* (*Gomphostilbia*) *samarense* sp. nov. A, frons and portion of face (left half); B-E, thoracic trichomes (B, mediodorsal; C, anterolateral; D, posterolateral; E, ventrolateral); F, gill filaments (right side and lateral view); G, basal portion of gill filaments (left side and lateral view); H, medium-long seta on dorsal surface of 1st abdominal segment; I, medium-long seta and very short seta on dorsal surface of 2nd abdominal segment; J, cone-shaped terminal hooks (end view). Scale bars. 0.1 mm for F; 0.05 mm for A and G; 0.02 mm for B-E, H and I; 0.01 mm for J.

length toward apex. Aedeagal membrane (Fig. 3K) densely covered with minute setae, not sclerotized basally, and not forming dorsal plate. Ventral surface of 10th abdominal segment (Fig. 3L, M) without distinct hairs near posterior margin on each side. Cercus (Fig. 3L, M) rounded, with 11–13 hairs.

Pupa. Body length 2.6 mm. **Head** (Fig. 4A). Integument dark yellow, moderately covered with small round tubercles; antennal sheath without any protuberances and tubercles; frons with 3 pairs of simple very long trichomes without coiled apices, and face with pair of simple very long trichomes with uncoiled apices; 3 frontal trichomes on each side arising close together, 1 of which is slightly longer than 2 others which are subequal in length to each other and to facial trichome.

Thorax. Integument dark yellow, moderately covered with small round tubercles, with 3 simple very long mediodorsal trichomes with coiled apices (Fig. 4B), 2 simple anterolateral trichomes (1 very long, with coiled apex, 1 medium-long, with uncoiled apex) (Fig. 4C), 1 simple medium-long posterolateral trichome with uncoiled apex (Fig. 4D) and 3 simple ventrolateral trichomes with uncoiled apex (1 long, 2 medium-long) (Fig. 4E) on each side. Gill (Fig. 4F, G) composed of 8 slender thread-like filaments, arranged in groups of $[(1+2)+(1+2)]+2$ filaments from dorsal to ventral: dorsal and medial triplets sharing very short common stalk; 2 filaments of ventral pair subequal in length (2.5 mm) and thickness to each other [though inner filament of right pair slightly shorter than outer filament (2.3 mm long), as shown in Fig. 4F] and much longer than 6 other filaments which are subequal in length (1.5–1.7 mm) and thickness to one another; common basal stalk very short, with somewhat swollen transparent organ ventrally at base; stalk of dorsal triplet directed upward and forward forming right angle to stalk of ventral pair; all filaments light brown, gradually tapered toward apex, with well-marked annular ridges and furrows though becoming indistinct apically; all filaments densely covered with minute tubercles. **Abdomen.** Dorsally, segments 1 and 2 light brown, with few small tubercles; segment 1 with 1 simple slender medium-long hair-like seta (Fig. 4H) on each side; segment 2 with 1 (left side) or 2 (right side) simple slender medium-long hair-like seta and 5 very short setae submedially (Fig. 4I) on each

side; segments 3 and 4 light brown along anterior margin, each with 4 hooked spines and 1 very short somewhat spinous seta on each side; segment 5 lacking spine-combs; segments 6–8 each with spine-combs in transverse row and comb-like groups of minute spines on each side; segment 9 yellow, with several small tubercles scattered, with comb-like groups of minute spines on each side, and pair of distinct cone-shaped terminal hooks (Fig. 4J). Ventrally, segment 4 with 1 bifid short brown hook (much shorter than those on segment 5) and few simple slender very short setae on each side; segment 5 with pair of bifid or trifid hooks submedially and few very short simple slender setae on each side; segments 6 and 7 each with pair of bifid inner and simple outer hooks somewhat spaced from each other and few very short simple slender setae on each side; segments 4–8 with comb-like groups of minute spines. Each side of segment 9 with 2 grapnel-shaped hooklets. **Cocoon.** Wall-pocket shaped, thinly and somewhat roughly woven, with several very small open interspaces in anterior web; anterior margin somewhat thickly woven, without any bulge or projection anterodorsally; posterior 1/2 with floor moderately woven; individual threads visible; 3.1 mm long by 1.2 mm wide; cocoon not extended ventrolaterally (probably because it was attached on a slender grass root, diameter about 1.0 mm).

Female and Mature larva. Unknown.

TYPE SPECIMEN. Holotype male (with associated pupal exuviae and cocoon) in ethanol, reared from a pupa, collected from a stream, Barangay Cabatuan, Western Samar Province, Samar, Philippines, 19. II. 2008, by H. Takaoka and V. F. Tenedero.

ECOLOGICAL NOTES. The pupa of this new species was collected from a slender grass root tailing in a small stream (width 1.5–2.5 m, water temperature 24.0°C, shaded, altitude 50–75 m), moderately flowing in a coconut plantation. The associated species was *S. (G.) salazarae*.

ETYMOLOGY. The species name *samarensis* refers to the island name,

Samar, where this new species was collected.

REMARKS. This new species is very similar to *S. (G.) davaoense* Takaoka, originally described from two males reared from pupae collected from Davao, Mindanao Island (Takaoka, 1983), in several morphological features including the number of vertical columns and horizontal rows of large upper-eye facets and the color of the legs and the shape of the ventral plate in the male and the shape of the terminal hooks in the pupa. However this new species is distinguished from the latter species in the male by the sensory vesicle with a large opening (Fig. 3A, B) (c.f., small opening in *S. (G.) davaoense*) and in the pupa by the middle triplet of the gill sharing a short common stalk with the dorsal triplet (Fig. 4G, F) (c.f., the middle triplet independently arises between the dorsal triplet and the ventral pair in *S. (G.) davaoense*) and the length ratio of the outer filament against the inner filament of the ventral pair (1.00–1.08) (c.f., 1.26 in *S. (G.) davaoense*). The morphological characters of *S. (G.) davaoense* noted here are based on the observation of the type specimen mounted on a glass slide (Bishop 12754) loaned from the B. P. Bishop Museum.

***Simulium (Simulium) baltazarae*
Delfinado**

Simulium baltazarae Delfinado, 1962: 50–53 (female, male and pupa).

Simulium (Simulium) baltazarae: Delfinado, 1971: 132; Takaoka, 1983: 120–124 (female, male, pupa and mature larva).

SPECIMENS EXAMINED. 2 females (with associated pupal exuviae and cocoon), reared from pupae, collected from a small stream (width 1.0–10.0 m, water temperature 24.5°C, partially shaded, altitude 20 m), moderately flowing in a coconut plantation, Barangay Serbantes, Northern Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero.

Tenedero.

DISTRIBUTION. Cebu, Leyte, Luzon, Mindanao, Mindoro, Negros and Samar.

***Simulium (Wallacellum) tuyense* Takaoka**

Simulium (Wallacellum) tuyense Takaoka, 1983: 38–39 (male, pupa and mature larva).

SPECIMENS EXAMINED. 1 female (with associated pupal exuviae and cocoon), reared from a pupa, collected from a small stream (width 1.0–10.0 m, water temperature 24.5°C, partially shaded, altitude 20 m), moderately flowing in a coconut plantation, Barangay Serbantes, Northern Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero; 1 male (with associated pupal exuviae and cocoon), reared from a pupa, collected from a small stream (width 0.5–2.0 m, water temperature 24.5°C, shaded, altitude 70–100 m), moderately flowing in a forest, Barangay Alang-Alang, Western Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero.

DISTRIBUTION. Luzon, Mindoro, Palawan and Samar (**New record**).

Simulium (Wallacellum) sp.

SPECIMENS EXAMINED. 15 females and 8 males (with associated pupal exuviae and cocoons), reared from pupae, and many immature larvae collected from a small stream (width 0.2–0.5 m, stream bed of rocks and stones, water temperature 25.0°C, exposed to sun, altitude 110–130 m), moderately flowing in a coconut plantation, Barangay Magsaysay, Western Samar, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. F. Tenedero.

DISTRIBUTION. Samar (**New record**).

REMARKS. This undescribed species is similar to *S. (W.) ogonukii* Takaoka, described from Mindanao (Takaoka, 1983).

and *S. (W.) molawinense* Takaoka (Takaoka, 2006) in that the cocoon is shoe-shaped, but differs from these two known species in many features including the arrangement of the pupal gill filaments and the genitalia of both sexes of adults. This species will be fully described in a separate paper, together with two other new species of the subgenus *Wallacellum*.

ACKNOWLEDGEMENTS

We are grateful to Prof. Peter H. Adler, Clemson University, USA, for reading the manuscript and giving valuable comments. Thanks are due to Prof. Lilian A. de las Llagas, University of the Philippines, for her support to this study. This study was financially supported by a Grant-in-Aid for Oversea Research from the Japan Society for the Promotion of

Science (No. 18406011).

REFERENCES

- Delfinado, M. 1962. The Philippine species of *Simulium* (Diptera: Simuliidae). *Philip. J. Sci.*, 89: 47–62.
- Delfinado, M. 1971. Some Simuliidae and Curtonotidae from the Philippines and the Bismarck Islands (Insecta, Diptera). *Steenstrupia*, 1: 131–139.
- Takaoka, H. 1983. The Blackflies (Diptera: Simuliidae) of the Philippines. xii+199 pp., Japan Society for the Promotion of Science, Tokyo.
- Takaoka, H. 2003. The Black Flies (Diptera: Simuliidae) of Sulawesi, Maluku and Irian Jaya. xxii+581 pp., Kyushu University Press, Fukuoka.
- Takaoka, H. 2006. Three new species of *Simulium* (*Wallacellum*) from Luzon Island, Philippines (Diptera: Simuliidae). *Med. Entomol. Zool.*, 57: 327–346.